

820 LINE STRIPING MATERIAL

820.01 GENERAL

The Contractor shall notify the District of the name, address, telephone number, and personal representative of the materials manufacturer(s) for materials supplied in accordance with this specification. Materials shall be sampled at the location of manufacture before their shipment. A certification from the manufacturer shall be submitted to the District, at time of materials delivery, which contains test results of materials delivered, that they conform to these specification requirements, and the date of manufacture and lot or batch number(s) of material delivered. Furnishing the certification does not relieve the Contractor of responsibility to furnish material in full compliance with this specification.

820.02 HOT EXTRUDED THERMOPLASTIC COMPOUND

White and yellow alkyd thermoplastic striping material shall conform to the requirements of AASHTO M 249.

Glass beads for use with thermoplastic striping materials shall conform to 820.05(A).

820.03 EPOXY THERMOPLASTIC (ETP)

(A) GENERAL. White and yellow epoxy thermoplastic (ETP) hot spray traffic marking materials for use on bituminous and portland cement concrete pavements shall be composed of two epoxy resins, calcium carbonate filler, glass beads, and either titanium dioxide pigment for white or silica-encapsulated lead chromate pigment for yellow formulation. This specification includes acceptance criteria for raw materials and for production lots of ETP. Compound shall be supplied in block form.

(B) APPLICABLE DOCUMENTS. The following documents are applicable:

AASHTO T 250 ASTM D 153	"Specific Gravity of Pigments"
AASHTO T 250 ASTM D 281	"Oil Absorption of Pigments by Spatula Rub-Out"
ASTM D 444	"Chemical Analysis of Zinc Yellow Pigment (Zinc Chromate Yellow)"
ASTM D 476	"Titanium Dioxide Pigments"
ASTM D 1199	"Calcium Carbonate Pigments"
ASTM D 1208	"Common Properties of Certain Pigments"
ASTM D 1394	"Chemical Analysis of White Titanium Pigments"
ASTM D 1652	"Epoxy Contents of Epoxy Resins"
ASTM D 2205	"Traffic Paints"
ASTM E 1349	"Color and Color Difference Measurement by Tristimulus"

(Filter) Colorimetry"

ASTM E 313	"Indexes of Whiteness and Yellowness of Nearwhite, Opaque Materials"
AASHTO T 53	"Softening Point of Asphalt (Bitumen) and Tar in Ethylene Glycol (Ring-and-Ball)"
AASHTO T 250	"Thermoplastic Traffic Line Material"
Report No. FHWA-RD-80-069	"Epoxy Thermoplastic Pavement Marking Material: Specification and Testing"
Fed. Test Method Std. No. 14 lb, Method 1022,	"Sampling (General)"

(C) COMPOSITION AND FORM OF MATERIALS. ETP shall have the following composition:

	White ETP		Yellow ETP	
	Parts by Wt.	%by Wt.	Parts by Wt.	%by Wt.
Solid epoxy resin	0.0	35.7 ± 0.5	30.0	36.0 ± 0.5
Liquid epoxy resin	20.0	23.8 ± 0.5	20.0	24.0 ± 0.5
titanium dioxide	10.0	11.9 ± 0.3	—	—
lead chromate	—	—	9.3	11.1 ± 0.3
calcium carbonate	10.0	11.9 ± 0.3	10.0	12.0 ± 0.3
glass beads	14.0	16.7 ± 0.4	14.0	16.8 ± 0.4

The white and yellow production ETP's shall meet the requirements of Table 1. Two (2) samples shall be tested for each batch. The bulk ETP properties (before and after heating) will be determined for each sample tested.

(D) COMPONENTS OF ETP COMPOUND.

(1) EPOXY RESINS. The liquid and solid resins shall be condensation products of bisphenol A and epichlorohydrin having the following properties:

	Liquid Epoxy Resin		Solid Epoxy Resin	
	Average	Difference	Average	Difference ^a
Viscosity, cps				
49°C, 20 RPM	680-810	10	—	—
232°C, 10 RPM	—	—	1300-2600	75
Epoxide Equiv. Wt.	180-196	10	1600-2300	50
g. equiv.				
a Between 2 replicates				

(2) TITANIUM DIOXIDE. The titanium dioxide shall conform to ASTM D 476, Type II. The oil absorption shall be between 13 and 30 grams oil/100 grams pigment with a maximum deviation between replicate samples of 1.0.

(3) CALCIUM CARBONATE. The calcium carbonate shall conform to ASTM D 1199, Type GC, Grade I with a dry brightness no less than 91 percent. The oil absorption shall be between 9 and 21 grams oil per 100 grams pigment with a maximum deviation between replicate samples of 1.0.

(4) LEAD CHROMATE. The lead chromate shall be refractory type, silica-encapsulated, and with no additive surface treatment. When tested it shall have the following properties:

	Min.	Max.	Max. Deviation Between Replicates
pH in 5 water-slurry	7.0	9.0	0.20
Specific gravity	3.8	4.5	0.01
Lead, by weight	44.0	50.0	0.51
Chromate, (CrO ₄) %by Wt.	17.0	27.0	0.51
Chromium (Cr), by Wt.	7.6	12.1	0.51

(E) GLASS BEADS. The glass beads shall be premixed and conform to 820.05(B).

(F) TESTING PROCEDURES. The test procedures and sample preparation procedures summarized in Section 4 of the Appendix A of "Epoxy Thermoplastic Traffic Marking Material", Implementation package FHWA-IP-82-14, July 1982 shall be used.

**TABLE 820 REQUIREMENTS FOR ETP
PRODUCTION BATCHES**

ETP PROPERTY	Difference^a between 2 Samples	Average of 2 Samples (White)	Average of 2 Samples (Yellow)
Before Heating			
Viscosity, cps (20 RPM) 232°C (450°F)	0.7	200-1400	150-1300
Softening Point, C	4.0	71.0-83.0	71.0-83.0
Reflectance, %	7.0	≥74	≥38
Whiteness Index	7.0	≥42	
Yellowness Index ^c	8.0		124-143
After Heating			
Viscosity Change, cps, 232°C (450°F)	250	-300 to +500 ^d	-250 to +600 ^d
Softening Point Change, C	4.0	-1.0 to +6.0 ^d	+1.5 to +9.5
Reflectance, %	7.0	≥77	≥39
Whiteness Index	8.0	≥31	
Yellowness Index	9.0		121-146
After Separation			
Total Organic, %	3.0	60.8-69.4	
	3.7		57.9-61.2
Beads, %	3.2	14.0-16.9	
	4.4		13.3-17.8
Titanium Dioxide, %	0.2	10.3-12.4	
Chromate, %	0.4		2.4-2.5
Lead, %	5.0		4.6-6.7
Epoxy Equivalent Wt. (Gram/Equiv.)	100	410-510	340-460
Infrared Spectrum	When directed by the Engineer, the infrared spectrum of production ETP shall match that at the initial source sample.		

- Two Samples are required for each batch. This column gives the maximum difference between the two samples. Columns 2 and 3 give permissible values for the average.
- Nu_{ay} = average viscosity of 2 samples.
- Conform to Highway Yellow Color Tolerance Chart (PR Color #1).
- E.g., $-300 \geq (Nu_a - Nu_b) \leq +500$ cps (Nu_b , Nu_a = viscosity before, after heating)

820.04 TRAFFIC PAINT

(A) SOLVENT BASED.

White and yellow solvent base traffic paint, ready mixed, shall conform to the requirements of AASHTO M 248, Type F. Beads shall be drop-on conforming to 820.05(C).

The solvent based traffic paint with beads shall dry to "no tracking" in 20 seconds or less when applied at 180 F at the specified thickness on a dry pavement.

(B) WATER BORNE. This specification covers white and yellow paint in combination with drop glass beads, separately packed for use. The paint shall conform to the following specifications:

(1) FORMULATION AND MANUFACTURING. The paint shall be free from defects and imperfections that might adversely affect the service ability of the finished product. The materials shall show no hard settling, gelling or spoilage on storage in the sealed containers as received that will affect the performance of the product. The paint shall be furnished ready for use. No additional thinner shall be added.

(2) DIRECTIONAL REFLECTANCE. The daylight directional reflectance of the white paint shall not be less than 85 percent and not less than 54 percent for yellow (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard 141b.

(3) FLEXIBILITY. The paint shall show no cracking or flaking when tested in accordance with FS TP-1952b.

(4) BLEEDING. The paint shall have a minimum bleeding ratio of 0.97 when tested in accordance with FS TT-P-1952b, Section 4.3.11. The asphalt saturated felt shall conform to FS HH-R-590.

(5) WEIGHT/GALLON. The paint shall be 12.0 pounds/gallon minimum and be within ± 2 pounds/gallon of the original qualification sample approved hereunder.

(6) COMPOSITION.

(a) The composition of the paint shall be left to the discretion of the manufacturer so long as the finished product is composed of a 100 percent acrylic emulsion and meets the requirements of this specification.

(b) Pigment percent by weight shall be 45-55 percent.

(c) Total non-volatile shall be 73 percent minimum.

(d) Non-volatile vehicle shall be 48 percent minimum.

(e) The volatile content of the paint shall contain less than 150 grams of volatile organic matter per liter of total non-volatile paint material.

(f) The volume of solids shall be 58 percent minimum.

(7) VISCOSITY. The consistency of the paint shall be not less than 70 or more than 90 Krebs Units at 25°C when tested in accordance with Federal Test Method Standard No. 141b.

(8) DRY OPACITY. The minimum contact ratio shall be .97 when drawn down with a .005 Bird applicator.

(9) WATER RESISTANCE. The paint shall conform to FS TT-P-115e, Section 4.3.3. There shall be no blistering or appreciable loss of adhesion, softening or other deterioration after examination.

(10) ABRASION RESISTANCE. No less than 210 liters of sand shall be required for removal of the paint film when tested in accordance with TT-P-1952b, Section 4.3.8.

(11) GLASS BEAD ADHESION. The paint with drop-on type beads, applied at the rate of six pounds-per- gallon of binder shall require not less than 550 liters of sand for removal of the beaded film. The test for bead adhesion shall be conducted in accordance with the Abrasion Resistance Test (10 above) and differing therefrom only in that the glass spheres shall be uniformly applied by gravity flow so as to obtain six pounds glass spheres per gallon of binder. The application of the glass spheres is to be a separate operation, but applied at the same time as the paint. Glass beads shall conform to 820.05(C).

(12) SCRUB RESISTANCE. The paint shall pass 300 cycles minimum when tested in accordance with ASTM D 2486.

(13) STORAGE STABILITY. After 30 days storage in a three-quarters filled closed container, the paint shall show no caking that cannot be readily remixed to a smooth, homogeneous state, no skinning, livering, curdling, or hard settling. The viscosity shall not change more than 5 KU's from the viscosity of the original sample.

(14) FREEZE-THAW STABILITY. When tested in accordance with TT-P1952b, Section 4.3.11, the paint shall not show coagulation or change in consistency greater than 5 KU, or a decrease in scrub resistance of greater than 10 percent.

(15) HEAT STABILITY. When tested in accordance with IT-P-1952b, Section 4.3.12, the paint shall show no coagulation, discoloration or change in consistency greater than 5 KU.

(16) FIELD APPLICATION AND STORAGE. The paint shall dry to no-tracking condition under traffic in one minute maximum when applied at 15 + or - 1 mil wet film thickness and 140-170°F, and from 3 to ten minutes when applied at ambient temperatures, with 6 pounds-per gallon of glass spheres. The paint shall not be applied at surface temperatures and air temperatures under 60°F.

(17) DILUTION TEST. The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with water only.

820.05 GLASS BEADS

(A) FOR HOT EXTRUDED THERMOPLASTIC. Glass beads shall meet the requirements of AASHTO M 247, Type II, and the moisture resistance requirements do apply.

(B) FOR EPOXY THERMOPLASTIC (ETP). Glass beads shall be premixed and shall meet the

requirements of ASTM D 2205, Type I in an amount of 4 to 5 lbs per gallon of ETP.

(C) FOR TRAFFIC PAINT. Glass beads shall be drop- on and shall meet the requirements of AASHTO M 247, Type I and the moisture resistance requirements do apply.